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OUTLINE ON CHAPT. 5

TUNED CIRCUITS AND RESONANCE

I. TUNED CIRCUITS.

A. Advantages:
1. High voltage gain posible at some frequency.
2. Low " " " " other "
3. May be used to short out some undesired frequency allowing the others to pass.
4. May also be used to pass one frequency and short out all others.

B. Conditions of resonance circuits:
1. $X_L = Xc$ (equal and opposite, so they cancell each other)
2. The frequency of any resonance circuit is: $F_o = \frac{1}{2\pi\sqrt{LC}}$
3. In a series circuit, the "I" is maximum and the "Z" is minimum.
4. In a paralell circuit, 'I' in the line is minimum and the 'Z' is maximum.

II. SERIES TUNED CIRCUITS.

A. Conditions on a series tuned circuits:
1. A series circuit is one where the signal originates within itself.
2. $Xc = X_L$. (equal and opposite).
3. The phase angle is 0. The circuit acts resistive since the only opposition to current is the resistance of the circuit.
4. The voltages across the reactive elements may be very high at the resonant fr. since the current is at maximum value.

B. Frequency:
1. The resonance fr. of the circuit $\frac{1}{2\pi\sqrt{LC}}$ and it depens entirely on the values of L and C.
2. Any combination of L and C may be used as long as their producs is the same.
3. Since X_L will increase if the fr. increases, the circuit above resonance acts inductive.
4. Since Xc increases if the fr. decreases, the circuit below resonance acts capacitive.

C. Resonance curves:
1. Curves are ploted with the current on the 'Y' axis and the fr. on the 'X' axis.
2. Since the peak of the curve indicates the current at resonance, the resistance of the circuit will determine the stepnes of the slope and heigth of the curve.
3. High resistance on the circuit will lower and flaten the curve and vice-versa.

D. Q of the series circuit:
1. The Q is an indication of merit of the circuit.
2. Q is the ratio of the voltage across the reactances to the applied voltage. $\frac{E_L \text{ OR } E_C}{E}$ OR $\frac{X_L}{R}$
3. The formula indicates that the lower the resistance the higher the Q will be.
4. The Q is also an indication of power consumed and it is the tangent of the phase angle.

E. Bandwith or bandpass of the circuit:
   1. Bandwith is the total number of cycles above or below the resonance fr. which realize the same voltage gain.
   2. Bandpass is the points of the curve where .707 of the peak current falls.
   3. Bandpass = $\frac{F_o}{Q}$ then the higher the Q the smaller the bandpass and vice-versa.

F. Applications of series tuned circuits:
   1. To pass a band of fr. and reject all others.
   2. To suppress a band and pass all others.

III. PARALELL TUNED CIRCUITS.

A. Conditions in a paralell tuned circuit:
   1. The circuit is paralell if the signal originates outside the ckt.
   2. $X_c = X_L$; $I_c = I_L$ Equal and 180 degrees out of phase.
   3. Since I_c and I_L cancell each other, the paralell tuned circuit presents maximum impedance to the line, therefore there is minimum current flowing.

B. Effects of frequency:
   1. If the fr. increases past resonance the Xc decreases, the Ic increases and the circuit acts capacitive.
   2. If the fr. goes below resonance the X_L decreases, the I_L increases and the circuit acts inductive.

C. Current in the tank circuit:
   1. Flywhed effect.
      a. With a paralell tuned circuit the line current is at minimum.
      b. Inside the tank, once the capacitor is charged there is an oscillatory current which in phase in both components. This current keeps oscillating as the capacitor charges and discharges through the coil,finding the circuit like a series tuned circuit, at minimum impedance.
      c. The fr. of the oscillations depens on the vlues of L & C.

D. The Q on a paralell circuit:
   1. The Q on a paralell circuit is the ratio of the current in the tank to the line current. $Q = \frac{I_c \text{ OR } I_L}{I} \text{ OR } \frac{X_L}{R}$
   2. The Q on a paralell circuit follows the same relationships than in a series circuit.

E. Resonant curves:
   1. The curves for a paralell circuit are ploted with the impedance on the Y axis and fr. on the X axis.
   2. At resonance there is maximum impedance, therefore the curve is stepest. Above and below resonance the impedance drops and the curve becames flat and broad.
   3. The band pass points are .707 of the max. peak of the curve.

F. Applications of paralel tuned circuits:
   1. To pass or reject a band of fr.

IV. FILTER CIRCUITS.

A. Combinations of series and paralell tuned circuits.
   1. As low pass or high pass filters.
   2. As band pass or band reject filters.